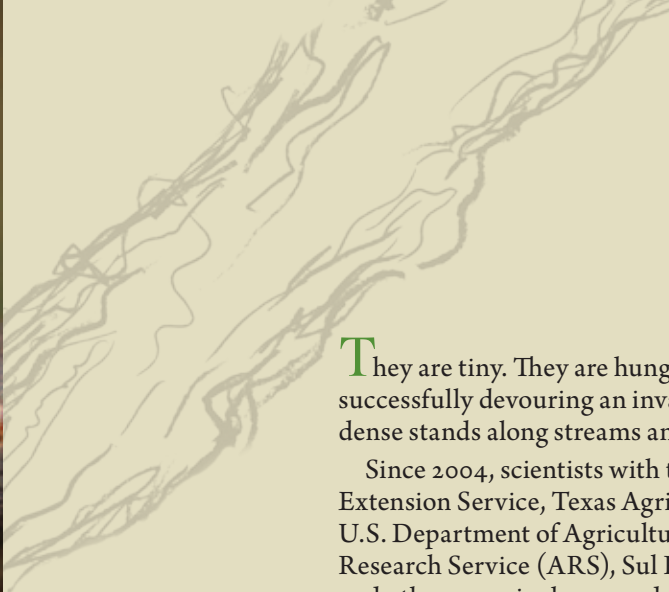


# Invited Invaders

*Beetles used successfully in biological control of saltcedar*



They are tiny. They are hungry. And thousands are successfully devouring an invasive tree that grows in dense stands along streams and rivers in West Texas.

Since 2004, scientists with the Texas AgriLife Extension Service, Texas AgriLife Research, U.S. Department of Agriculture's Agricultural Research Service (ARS), Sul Ross State University, and other agencies have used varieties of saltcedar leaf beetles to defoliate miles of the invasive saltcedar tree in the Colorado, Red, Brazos, Canadian, and Rio Grande (including the Pecos River) river basins.

The non-native saltcedars, brought to the western United States from Asia and the Mediterranean area in the early 1800s, were planted as ornamentals in landscapes and along stream banks to prevent erosion. With no natural enemies in the country, the exotic tree spread to more than 2 million acres of land along streams and lakes from the central Great Plains to the Pacific and from Montana into northern Mexico.

Their growth, however, has "produced one of the worst ecological disasters in the recorded history of the region [western United States]," according to a 2000 review of the problem by Dr. Jack DeLoach, an ARS entomologist in Temple, and other scientists involved in combating saltcedar in Texas.

These trees often displace native plants, degrade wildlife habitats, and contribute to the population decline of animal and plant species. They also increase soil salinity and the likelihood of wildfires, lower water tables, and reduce recreational usage of parks and natural areas, the report stated.

To fight this invasion, ARS scientists imported saltcedar beetles first from China and then Greece, Tunisia, and Uzbekistan to test their use and safety as biological control agents. These tiny beetles—about a quarter-inch long—chew the leaves of the saltcedar trees, and after three to four years of repeated defoliation, the trees begin to die.

In April 2004, DeLoach and Dr. Allen Knutson, Texas AgriLife Extension Service entomologist at the Texas AgriLife Research and Extension Center at Dallas, released 38 Crete (Greece) beetles at a research site along Beals Creek near Big Spring in West Texas. Over the summer of that year, the scientists released an additional 2,200 beetles.

"Since then, no additional beetles have ever been released [at this particular site]," DeLoach

said. Those beetles and their offspring established themselves and began defoliating the saltcedar.

In 2005, the beetles defoliated 2 acres of trees; the next year, 20 acres, and they kept going. By 2009, the beetles had "just exploded" and had moved 38 miles along Beals Creek, defoliating about 500 to 1,000 acres, DeLoach said.

The time was right, Knutson said, to move the project from research to implementation. "We felt we had enough research and a large source of beetles to begin implementing biological control of saltcedar in the major river basins of West Texas," he said.

Knutson, in partnership with ARS and the USDA's Natural Resource Conservation Service (NRCS), established a statewide *Saltcedar Biological Control Implementation Program*. The program provides technical assistance and beetles to agencies and landowners interested in saltcedar biological control and educates people on this project.

Working with the Colorado River Municipal Water District, Knutson has established saltcedar beetle populations at four locations on the upper Colorado River Basin, and, in 2010, released beetles at Lakes Ivie and Spence. This project is funded by Wal-Mart Stores Inc. and the Texas Parks and Wildlife Foundation, Knutson said.

Knutson also works closely with NRCS in establishing new beetle populations in the saltcedar-infested regions in the Southern and Rolling Plains of Texas. During 2010, the AgriLife Extension program provided 90,000 beetles to NRCS personnel for release in five counties.

"When we say 'established,' that means the beetle population has overwintered and come back and defoliated trees," Knutson explained. "It takes quite a bit of effort, heart, and science to establish beetles."

During the past two years, Knutson collected about 550,000 beetles from the Big Spring area and distributed them throughout West Texas, from Big Bend National Park on the Rio Grande as far north as White River Lake near Crosbyton. By 2010, the AgriLife Extension program had released beetles at 23 sites in 17 counties.

"These new beetle populations are now defoliating saltcedar at these sites. The defoliated areas range from 1 to 2 acres to 80 acres and will expand as beetle populations increase each year," Knutson said. ➡

Scientists in Texas are using the saltcedar beetle to control invasive saltcedar trees. No species of saltcedar or its close relative, athel tree, are native to North or South America. Photo by Jerry Michels, Texas AgriLife Research.



Working closely with Knutson is Dr. Mark Muegge, AgriLife Extension entomologist at Fort Stockton. He concentrates on sites along the Pecos River and sites in Big Bend National Park. He has found that the Crete beetle works for the northern part of the Pecos River, and the Tunisian beetle from Northern Africa survives better in the southern portions of the Pecos and the Rio Grande.

"We released Crete beetles from a field cage along the Pecos in the summer of 2006," Muegge said, "and the beetles now cover an area from Mentone down to near Barstow, and they have defoliated probably 25 to 30 river miles of saltcedar."

After four years, Muegge said, the trees close to the original release site are definitely showing signs of decline from repeated defoliation by the beetles. "We believe these trees will start dying and may be dead in another couple of years," he said.

Beetles continue to feed on new growth season after season. After each defoliation, the saltcedar resprouts but with decreasing green foliage each year.

"The beetles never are expected to kill all the trees," DeLoach said. "They will decrease as green foliage decreases, and both beetles and green saltcedar are expected to reach a low, nondamaging and fluctuating equilibrium after five to eight years."

Even if the trees are not dead, Knutson said, defoliated trees are stressed and their canopies are greatly reduced. "Branches die, and as more sunlight reaches the soil, other plants begin to grow as the saltcedar dies back," he said. "The stressed trees stop producing flowers and seeds. Fewer seeds result in less reinfestation."

Dr. Chris Ritzi of Sul Ross works with DeLoach, the Rio Grande Institute, and NRCS in parts of the Rio Grande Basin, which has the "largest, continuous stretch of saltcedar in the state," he said.

Ritzi said they initially tested three beetle species—Crete, Tunisian, and Uzbekistan—to determine if one would work in that area. Over time, they determined that the Tunisian beetle was best suited to this area.

To date, about 14 research sites established by Ritzi and DeLoach are along the Rio Grande, including one well-established site at Alamito Creek, from which beetles have defoliated more than 20 miles of saltcedar trees along the Rio Grande between Lajitas and Candelaria.

Besides finding the right beetles for the different areas, Ritzi said, another problem was protecting the sites while the insects were established, such as preventing ants from eating the pupae and carrying away the larva. "The ants ate the beetle larvae like candy," he said. "It was very difficult to get the beetles to take to this area."

Research by Knutson and Muegge found that applying ant bait at the release site helps prevent ants from eating the beetles until the beetle population has grown large enough to handle the ant attacks.

The periodic flooding of the Rio Grande has also caused problems in getting the beetles established, Ritzi said. In the beetles' pupal stage, they drop to the ground to go into metamorphosis, and if the river floods, they drown.

"Flooding can really hurt the beetles, and can kill off an entire generation," he said.

In the Texas Panhandle, Dr. Jerry Michels of Texas AgriLife Research also has had trouble finding the right beetle strain that can survive the conditions of the Panhandle's unique environment. Because of the northern location of the Canadian River, Michels tried to establish beetle species used successfully in Utah, Nevada, and Colorado. He found, however, that none of those species overwintered well in the sites on the Canadian River.

In 2010, Michels released 17,000 Crete beetles. He is hoping that spring 2011 brings better results with the beetles overwintering and coming out of hibernation.

"We are waiting until next spring to see if these beetles will be established," Michels said of the anticipated breakthrough. "We saw some defoliation even this summer, but we need the beetles to make it through winter to say they are established."

What is the most important reason to establish these beetles and get rid of saltcedar? The answer really depends on who you ask, and where the saltcedar is growing.

"We are very concerned about the impact of saltcedar on water more than anything else," Michels said, adding that he believes saltcedar has contributed to the depleted water reservoirs of Lake Meredith, north of Amarillo.

In an April 2010 U.S. Geological Survey (USGS) report requested by Congress, scientists from USGS, U.S. Bureau of Reclamation, U.S. Forest Service, and other agencies conducted a review of scientific literature on saltcedar. According to a USGS news release, scientists found that native trees such as cottonwoods and willows consume as much water as saltcedar on a leaf-area or soil-area



Adult cedar beetles are about 5 mm long and feed on saltcedar flower buds. Photo courtesy of Agricultural Research Service.

basis, and that other vegetation that replaces saltcedar after its removal consumes “roughly equal amounts of water.”

“Therefore, removal of saltcedar from these areas is unlikely to produce measurable water savings once replacement revegetation becomes established,” the authors wrote.

DeLoach and Michels said although plant-for-plant that statement may be true, the difference is that healthy habitats don’t have the huge, dense stands of cottonwoods and willows taking up large amounts of water as saltcedar-invaded habitats do.

“With a healthy habitat, you have a mix of cottonwoods, willows, other trees, some woody plants, broadleaf plants, and grasses,” Michels said. “But with solid stands of saltcedar there is almost nothing else, especially when the canopy becomes dense.”

DeLoach said, “If you look at the whole floodplain of a river, deep-rooted saltcedar occupies a lot more land across the floodplain, while shallow-rooted cottonwoods and willows stay close to the stream. If you consider that, then saltcedar uses a lot more water than cottonwoods and willows do.”

But for DeLoach, the reasons for controlling saltcedar depend on the damage caused by saltcedar in different environments. “The reasons might be to improve native plant communities and wildlife and fish habitat, to increase water quantity and quality, to reduce wildfires and soil salinity, or to improve recreational values in parks and natural areas—all are important,” he said.

“Plants are going to use water—that’s a given,” Ritzi agreed, “but the question is what sort of plants are going to grow, and what type of organisms can base their community around those plants. The truth is very few things want to make a home out of saltcedar.

“Saltcedar really does reshape the entire river system and how everything seems to work within that system,” he said. “We are ultimately looking to reshape and restore the habitat. We are hoping that the renewal of the natural system will get the river ecosystem closer to what it used to be.”

Late last summer, this program, called one of the most successful biological control programs for invasive weeds in the United States, hit a potential bump in the road in the Rio Grande area of Texas. The Tunisian beetles, released at several sites along the river in 2009, had increased so rapidly that they defoliated almost all of the saltcedar along 20 miles of the Rio Grande near Presidio. In August 2010, the beetles jumped to a close cousin, the athel tree, used as a shade tree in Presidio and northern Mexico. The beetles defoliated about 20 athel trees in Presidio.

Previous extensive tests by ARS had shown that the beetles feed on athel trees, but prefer saltcedar.

DeLoach believes, based on the few cases of biocontrol insects attacking nontarget weeds in other areas, the damage to athel will drop over the next two to three years. Since the beetles have defoliated all the desirable trees, next year the beetle population will be lower and the beetles will concentrate more on the preferred saltcedar and less on the athel, he said.

“A few more years of careful monitoring will be critical to discover if that will really happen in the field,” he said.

Because the athel tree survives only along the Rio Grande in Texas, Knutson said, it is not an issue for the saltcedar biocontrol efforts in the other West Texas river basins.

The scientists said the next step for this program is to wait for the beetles to do what they do best.

“My goal is to get large populations established on each of these major river basins and then let beetles disperse naturally,” Knutson said. “The beetles can fly long distances in search of saltcedar trees. We hope to have beetles in all areas of West Texas within three more years. That doesn’t mean there will be a beetle in every saltcedar tree, but over time, they will disperse throughout the region and have an area-wide impact on saltcedar.”

“I think saltcedar beetles are going to be a long-term solution to controlling and managing saltcedar along all the watersheds where it occurs,” Muegge said. “Once the beetles are established, it’s the cheap way to go, and it’s environmentally sound.”

Michels said agencies and others have used herbicides and mechanical control to remove saltcedar, but those practices are very expensive. “If we can get biological control established, it’s self-renewing,” he said. “You don’t have to pay more money each year.”

Judging from the success of the program in other western states that began before the Texas program, DeLoach predicts “spectacular and very rapidly increasing success.”

Nevada has 340 river miles of almost total defoliation, and beetles released on the Colorado River have done well, defoliating about 1,000 river miles in Utah, western Colorado, and northwestern New Mexico since 2005.

“This gives us a perspective of what we could have here,” DeLoach said. “We could have 1,000 miles or more defoliated in another two or three years.”

For more information on saltcedar control in Texas, visit [twri.tamu.edu/txH2O](http://twri.tamu.edu/txH2O). 🍷